The Relationship Between Nurse Staffing, Quality, And Financial Performance In Hospitals

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ABSTRACT

Little evidence exists on the relationship of nurse staffing and quality with financial performance in hospitals. This study aimed to measure the relationship between nurse staffing, quality of care, and profitability in hospitals. This study used longitudinal panel datasets from 2006 to 2010, drawn from various datasets including the American Hospital Association Annual Survey Database, Medicare Cost Report, and Hospital Compare Data. This study used the random-effects linear regression model to measure the relationship between nurse staffing, quality, and profitability. In addition, we tested a mediating effect of quality on the relationship between nurse staffing and profitability. This study found nurse staffing's significant association with quality and profitability in hospitals. First, compared to hospitals in the lowest quintile of RNs per 1,000 inpatient days, hospitals in the higher quintiles had lower pneumonia readmission rates, and higher total profit margins, operating margins, and cash flow margins. In addition, hospitals with lower pneumonia readmission rates were found to have higher total profit margins and cash flow margins. Lastly, the current study found that the positive relationship between RNs per 1,000 inpatient days and total profit margin and cash flow margin was partially mediated by pneumonia readmission rates. In conclusion, our finding that nurse staffing is positively associated with both quality of care and profitability in hospitals suggests that the idea of hospitals responding to financial pressures by cutting RN resources with a goal of greater profitability should be called into question. The influence of lower RN staffing levels on higher profitability for hospitals is uncertain, while it is possible that RN staff reductions may compromise the quality of patient care.

Keywords: nurse staffing, registered nurse, quality of care, readmission rate, profitability, total profit margin, operating margin, cash flow margin, hospital.

INTRODUCTION

Staffing strategy involves decision making that pertains to either staffing levels (e.g., overstaffing vs. understaffing) or staffing quality (e.g., exceptional vs. acceptable workforce quality) (Herneman III & Judge, 2006, p. 23). Organization literature suggests that human resource (HR) practices are closely related to organizational performance (Delaney & Huselid, 1996; Huselid, 1995). Maintaining adequate staffing levels is a crucial organizational activity to a hospital because it can influence quality and financial conditions. Because registered nurses' (RNs) wages and benefits represent a significant portion of the hospital's operating budget, managing RN staffing levels is a major factor in reducing hospital costs (Rivers, Tsai, & Munchus, 2005). Yet, inadequate nurse staffing may lead to lower production efficiency and poor quality of care delivered to patients because nurses directly take part in the core technology of hospitals and deliver patient care (Bloom, Alexander, & Nuchols, 1997).

The effect of nurse staffing on quality outcomes is well established in the literature. For example, higher nurse staffing levels have been consistently linked to lower mortality rates (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Elting et al., 2005; Mark, Harless, McCue, & Xu, 2004) and lower readmissions (McHugh & Ma, 2013; Weiss, Yakusheva, & Bobay, 2011) in hospitals. However, little is known about the relationship between nurse staffing and profitability in hospitals. Few studies have examined the influence of nurse staffing patterns on profitability in hospitals: a non-significant relationship (McCue, Mark, & Harless, 2003); and a positive relationship in competitive markets (Everhart, Neff, Al-Amin, Nogle, & Weech-Maldonado, 2013).

Using the resource based view of the firm perspective, this study attempted to examine the association between nurse staffing, the quality, and financial performance in hospitals. Specifically, how nurse staffing is associated with hospital profitability through its impact on quality was investigated by testing a mediating effect. To our knowledge, there have been no prior studies examining the mediating effect of quality on the relationship between nurse staffing and hospital profitability. The findings of this study are expected to help hospital managers and administrators better understand the gains and losses of changing nurse staffing in terms of quality and profitability. This could assist them in making better staffing decisions.

LITERATURE REVIEW

To investigate how nurse staffing influences hospital performance, the current study draws on the resource based view of the firm that is rooted in organizational economics and strategic management. This perspective conceptualizes that performance differences across firms are attributable to the variance in the firm's resources and capabilities (Hitt, Bierman, Shimizu, & Kochhar, 2001). It suggests that organizations make strategic choices on securing and using their internal resources and that their strategic decisions enable them to generate sustained competitive advantage (Barney, 1991; Short, Palmer, & Ketchen, 2002).

According to Barney (1991), these internal resources may comprise human capital resources, including their experience, judgment, and intelligence. Under the resource based view of the firm, valuable resources are the source of a competitive advantage for firms. Barney describes that competitive advantage is obtained by implementing a value-creating strategy that cannot be easily copied and sustained by competitors. Barney further describes "sustained competitive advantage" as occurring only when other firms are incapable of duplicating the benefits of a competitive

advantage (Barney, 1991, p. 102). To have the potential of sustained competitive advantages, resources of a firm should have four attributes (Barney, 1991): 1) the resource must add positive value to the firm; 2) the resource must be unique or rare among its current and potential competitors; 3) the source must be imperfectly imitable; and 4) the resource cannot be substituted with another resource by competitors.

This study posits that managing effective nurse staffing is a value-creating strategy that satisfies the four attributes of sustained competitive advantage. First, the nursing workforce is a valuable resource in a hospital. Research supports the favorable performance implications of nurse staffing patterns in hospitals, with respect to better quality of care and higher efficiency of care (Cho, Ketefian, Barkauskas, & Smith, 2003; Mark et al., 2004; McHugh & Ma, 2013). When a resource enables a firm to execute strategies that increase its efficiency and effectiveness, the resource is regarded as valuable (Barney, 1991). Therefore, nurses are valuable and crucial elements to make hospital patient services efficient and effective (McCue et al., 2003).

In addition, nurses, especially RNs, can be considered a relatively rare resource. Previous studies characterized the market environment of acute care hospitals as hospitals competing for crucial resources (e.g., human capital), while seeking cost containment and maintaining quality (Morrisey, 2001; Thomson, 1994). Given that the shortage of RNs is expected in the next decade (Buerhaus, Auerbach, & Staiger, 2009) and improving nurse retention has been a subject of substantial research (Gardner, 2010), securing a proper level of nurses is an important managerial and operational issue for hospitals.

Barney (1991) suggests that socially complex resources are hard to imitate because they are embedded in complicated social systems. Nurse staffing can be seen as part of a socially complex system because nurses interact with various types of hospital personnel in patient care and have tacit knowledge of their relations with those personnel and organizational routines (Coff, 1997). Tacit knowledge is generally embedded in organizational routines and interpersonal relationships in organizational work environments. Because such knowledge is not easily articulable, and transferring it is slow and complex (Lei, Hitt, & Bettis, 1996; Teece, 1998; Weech-Maldonado, Meret-Hanke, Neff, & Mor, 2004), it is less likely to be perfectly imitable. Therefore, this study suggests that the tacit knowledge of nurses is imperfectly imitable.

Finally, compared with licensed practical nurses (LPNs), RNs receive more training and are regarded as having higher skill levels (Spetz, Dyer, Chapman, & Seago, 2006). Certain duties can be performed only by RNs. In general, LPNs are restricted from medication administration, administering blood products, and providing other types of care that are critical in hospitals, and they are less likely to function as charge nurses or team leaders in hospitals (Spetz et al., 2006). Although replacing an RN with a new RN from the outside is possible, the tacit knowledge of RNs, such as the knowledge gained from their roles as supervisors in interpersonal relationships for patient care and organizational routines, is not perfectly substitutable with the knowledge of new RNs.

Based on the discussion above, this study posits that nurses, especially the knowledge and experience of skilled nurses as RNs, are a source of a competitive advantage in hospitals, and the

hospitals can obtain sustained competitive advantage by implementing a value-creating strategy (i.e., creating effective nurse staffing patterns).

Nurse Staffing, Quality and Financial Outcomes

Figure 1 introduces the conceptual model of this study, which depicts the relationship between nurse staffing, quality, and financial outcomes. Previous organizational research has supported the positive influence of human capital management on organizational performance (Arthur, 1994; Delaney & Huselid, 1996; Hitt et al., 2001; Huselid, 1995). Human capital attributes, regarding education, experience, and skills, positively influence outcomes in organizations (Hitt et al., 2001; Huselid, 1995). RNs comprise the largest group of healthcare professionals and –
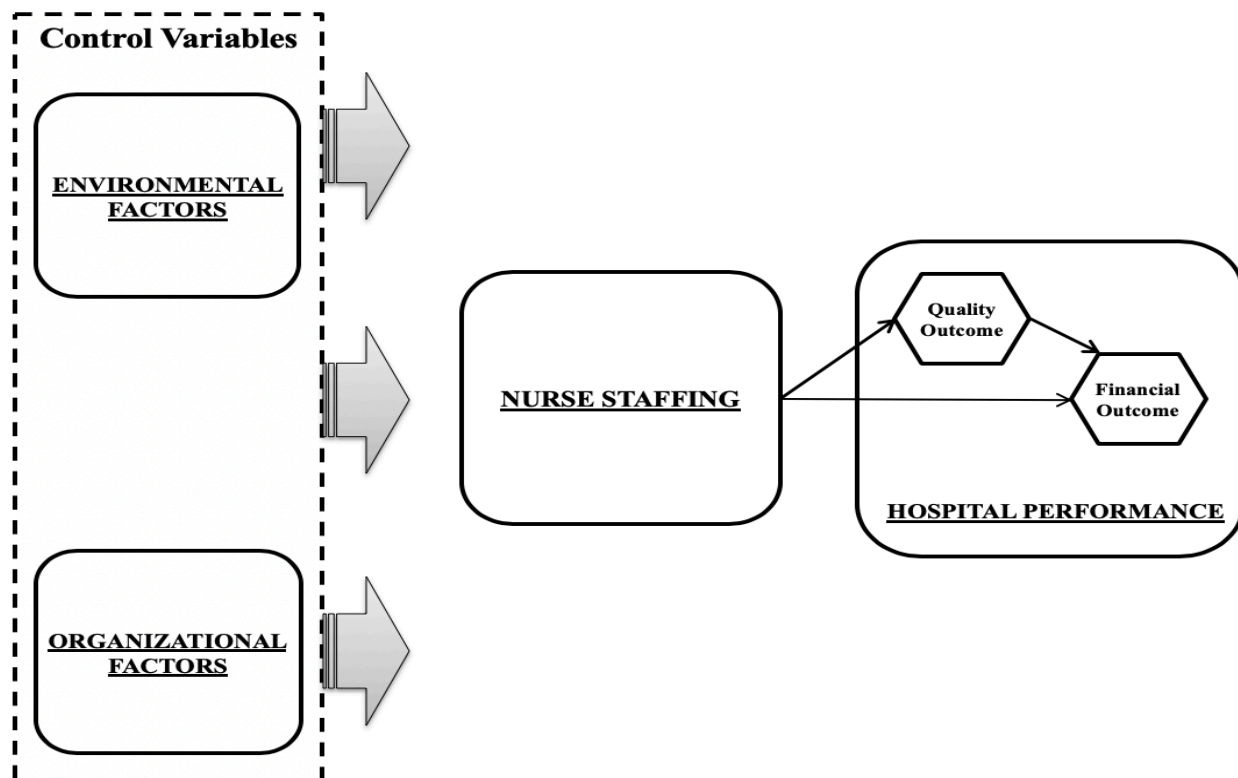
Figure 1. **Conceptual Framework.**

proper levels of nurse staffing are found to be associated with the quality of patient care (Unruh, 2008). Previous studies generally support that higher staffing levels of RNs result in lower hospital mortality (Aiken et al., 2002; Elting et al., 2005; Mark et al., 2004; Needleman et al., 2011; Person et al., 2004) and readmission (McHugh & Ma, 2013; Weiss et al., 2011). A previous meta-analysis also confirmed that higher RN staffing levels lead to favorable patient outcomes (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). Therefore, full-time RNs may contribute to the improved quality of patient care through their higher levels of tacit knowledge and organizational commitment. H1: Hospitals with a higher RN staffing level will have better quality than hospitals with a lower RN staffing level.

Higher quality in facilities is expected to be achieved at higher costs. However, Binns (1991) argued that quality products in the healthcare field can reduce defects and the amount of waste, thereby

reducing production costs. Moreover, it has been argued that higher quality may result in lower patient costs, as a result of improved productivity from quicker patient recovery and more efficient processes (Harkey & Vraciu, 1992). For example, hospital staffing with more skilled nurses may effectively control the occurrence of adverse events that may increase the length of stay (LOS) and the mortality rate (Cho et al., 2003). According to Dall, Chen, Seifert, Maddox, and Hogan (2009), increasing RN staffing levels is expected to decrease the risk of complications in patients (e.g., nosocomial) and their LOS, thereby achieving medical cost savings.

As discussed above, quality may lead to lower costs per patient by improving productivity. Specially, under diagnosis-related group (DRG) and per diem payment systems, higher quality may lead to higher profitability through its impact on the lower costs per patient. Similarly, third-party payers under fee-for-service arrangements may benefit from higher quality as a result of fewer services billed through more efficient delivery (Harkey & Vraciu, 1992). Furthermore, hospitals could use higher quality as a differentiation strategy to increase their market share of more lucrative patients with private insurance, thereby increasing their financial performance (Velez-Gonzalez, Pradhan, & Weech-Maldonado, 2011).

Previous studies have found perceived quality and the Joint Commission's quality scores on hospitals to be positively associated with operating margin (Harkey & Vraciu, 1992) and both the total margin and the operating margin (Velez-Gonzalez et al., 2011), respectively. Similarly, previous research has linked poor-quality hospitals, which were underinvested and understaffed (Cleverley & Harvey, 1992) with increasing readmissions (Epstein, Bogen, Dreyer, & Thorpe, 1991), to lower profitability. The quality of care has been found to have a positive influence on the operating margin in nursing homes via its inverse impact on the costs of patient care (Weech-Maldonado, Neff, & Mor, 2003a, 2003b). H2: High-quality hospitals will have higher profitability than low-quality hospitals.

Nelson et al. (1992) have reported that a patient's impression of a hospital's quality may explain 17%–27% variation in hospital financial measures. Staffing inputs are highly visual to patients and physicians, and, proportionately, more RNs in nursing staffs are regarded as an indication of higher quality (Robinson, 1988). Harkey and Vraciu (1992) found that the perceived higher quality by patient, physicians, community residents, and employees was associated with a higher operating margin in hospitals. Likewise, poor-quality hospitals found to be less profitable were underinvested in assets and understaffed (Cleverley & Harvey, 1992).

Although there is a paucity of empirical evidence, two studies reported some evidence in the association between nurse staffing and profitability in hospitals. Everhart et al. (2013) found that using more RNs per inpatient day positively influenced the profit margin in hospitals located in competitive markets. Conversely, the findings of McCue et al. (2003) suggest that using more RNs is likely to increase costs but not necessarily lower the operating margin. H3: Hospitals with a higher RN staffing level will have a higher profitability than hospitals with a lower RN staffing level.

Combining the discussions above, we may argue that hospitals with a higher RN staffing level can experience better quality outcomes and that those hospitals' staffing can be associated with greater hospital profitability because the hospitals' improved quality of care in association with their higher RN staffing level can lead to greater profitability.

H4: In hospitals, the positive relationship between RN staffing level and profitability in hospitals will be mediated by quality.

RESEARCH METHODS

This study is designed as a non-experimental longitudinal study using secondary data analysis. The following longitudinal panel datasets from 2006 to 2010 were used: the Centers for Medicare & Medicaid Services (CMS) Medicare Cost Report; the American Hospital Association (AHA) Annual Survey Database; U.S. Department of Health and Human Services (HHS) Area Health Resource File (AHRF); the CMS Hospital Compare Data; the Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS); and the Magnet Hospital status data (https://www.nursingworld.org/organizational-programs/magnet/find-a-magnet-organization/).

The Medicare Cost Report includes data related to facility characteristics, utilization data, cost and charges by cost center, and financial performance. The AHA Annual Survey Database provides data for U.S. hospitals, such as organizational characteristics, utilization, staffing, and expenses. The AHRF dataset includes county-level data with respect to health facilities, health professions, resource scarcity measures, health status, economic activities, health training programs, and socioeconomic and environmental characteristics. The Hospital Compare dataset provides data about hospital quality. The LAUS data include information on the total employment and unemployment monthly estimates for different geographical levels. Lastly, the data indicating a hospital's Magnet Hospital status are collected manually from the American Nurses Credentialing Center website.

Sample

The unit of analysis is hospital-years. The sampling frame consists of U.S. general, acute-care, non-federal hospitals. The Hospital Compare data consist of moving average data for three years. For example, the data released in December 2010 include the data collected from July 2006 to June 2009. To match the time period with the Hospital Compare data, this study computed an average using two years of data from each of the other datasets. For example, the Hospital Compare moving average of data collected from July 2005 to June 2008 was matched with the moving average of data between 2006 and 2007 for each of the other datasets used in this study. After merging the datasets, the final sample includes 3,911; 3,950; 4,020; and 4,074 hospitals in each time point, respectively (i.e., 2006-07, 2007-08, 2008-09, and 2009-10). Finally, the current study uses the panel data of 15,955 hospital-years in the analysis.

Variables
Dependent Variables: Financial Outcome

Table 1 provides definitions and the data sources for all study variables. The financial outcome in terms of profitability was measured by the total profit margin,

Table 1. Summary of Variables

Variable	Definition	Data Source
Dependent Variable		
Financial outcomes (Profitability)		
Total profit margin	Net income/total revenues	CMS
Operating margin	operating income/total operating revenues	CMS
Cash flow margin	(Net income – (contribution, investments and appropriation) + depreciation + interest)/(total revenues –(contributions, investments, and appropriations))	CMS
Mediator		
Quality		
Pneumonia readmission rate	An estimate of readmission rate within 30 days of a hospital discharge among patient hospitalized due to pneumonia	CMS
Independent Variable		
Nurse Staffing		
RN staffing level	RN FTEs/(Inpatient days/1000)	AHA
Control Variable		
Environmental factors		
Per capita income	Mean income within county ($1000)	AHRF
Urban location	Location in urban areas (1: yes, 0: No)	AHA
Specialist resources	# of physician specialists per 1,000 capita	AHRF
Medicare HMO penetration	Medicare HMO enrollment as percent of total Medicare population in a county	AHRF
Change in unemployment rate	yearly change in county unemployment rate	LAUS
HHI	The sum of squared market share of all hospitals in HSA	AHA
Organizational factors		
Bed size	The number of staffed inpatient beds	AHA
System affiliation	Status of a hospital's membership in multihospital systems (1: system, 0: non-system)	AHA
Ownership	Status of a hospital as a for-profit or not-for-profit entity (1: for-profit, 2: not-for-profit private, 3: public)	AHA
Teaching status	Existence of approved medical residency programs, affiliation with medical school or COTH membership (1: teaching, 0: non-teaching)	AHA
Occupancy rate	total inpatient days/number of staffed beds*365	AHA
Magnet status	Status of Magnet credentialing (1: Magnet, 0: non-Magnet)	Magnet Hospital
LPN staffing level	LPN FTEs/(Inpatient days/1000)	AHA

operating margin, and cash flow margin. Total profit margin was defined as "net income divided by total revenues;" operating margin was defined as "operating income divided by operating revenues" (Gapenski, 2003, pp. 440-441); and cash flow margin was defined as "sum of net income and depreciation expense, subtracting contributions, investments and appropriation, divided by total revenues, subtracting contributions, investments and appropriation" (Pink et al., 2005). Compared to profit margin, the advantage of operating margin is its focus on core business operations, thereby getting rid of the influence of non-operating revenues and costs, which may be

transitory and not pertinent to core operations (Gapenski, 2003). According to a report made under contract with the federal Office of Rural Health Policy (Pink et al., 2005), the most frequently used indicator of profitability in the literature was operating margin, followed by total margin and cash flow margin. Previous hospital-nurse staffing research has often used profit margin (Everhart et al., 2013) and operating margin (Mark, Harless, & McCue, 2005; Mark et al., 2004; McCue et al., 2003), but not cash flow margin. Cash flow margin is chosen to measure the ability of hospitals to generate cash flow from patient care services because of its focus on the ability to pay only for current operations and existing capital.

Mediator: Quality

In this paper, the quality outcome of a hospital was measured by risk-adjusted pneumonia readmission rates from the CMS Hospital Compare Data. The readmission rate was chosen as a quality indicator because previous nurse staffing studies have often used it as a quality measure (McHugh, Berez, & Small, 2013; McHugh & Ma, 2013; Weiss et al., 2011). Another reason readmission rate was chosen is that this paper aimed to capture the relationship between nurse staffing, quality, and financial outcomes in hospitals, prior to the introduction of the Hospital Readmissions Reduction Program (HRRP) under the Affordable Care Act (ACA) that reduces DRG payments for hospitals with excess readmissions, because the relationship of interest in this study might have changed after the program's effective day in October 2012.

The CMS provides 30-day readmission rates for pneumonia, which were adjusted for patient characteristics related to their risk of dying or unplanned readmission, such as age, past medical history, and other comorbidities at the time of admission (Medicare.gov, 2014). This adjustment was made to compare hospital performance fairly and level the playing field (Medicare.gov, 2014). The Hospital Compare Data also includes 30-day readmission rates for heart attack and heart failure. This paper used the readmission rate for pneumonia rather than for heart failure or heart attack because it had relatively fewer missing cases (i.e., 846 [5%] than others, i.e., 1,513 [9%] and 7,512 [45%], respectively) in the data from 2006 to 2010. Based on Medicare.gov (2014), the current study defines pneumonia readmission rates as the estimate of readmissions within 30 days of a hospital discharge among patients hospitalized due to pneumonia.

Independent Variable: Nurse Staffing

This study utilized RN staffing level as the nurse staffing variable to measure how a hospital intensively uses RN resources to provide a certain amount of patient care (Everhart et al., 2013). This variable as defined as RN Full-time equivalents (FTEs) divided by 1,000 inpatient days.

Control Variables: Contextual Factors
Environmental Factors

This study included six environmental factors as control variables. First, three variables were measured at the county-level, representing the degree of resource abundance in the environment: per capita income, urban location, and specialist resources. These variables have been used in hospital-nurse staffing studies (Bloom et al., 1997; Everhart et al., 2013; Mark & Harless, 2007; McCue et al., 2003; Zhao et al., 2008). Per capita income was defined as the mean income within a county. Urban location was measured using the 2003 Rural/Urban Continuum Codes in the ARF dataset. It was coded as a binary measure ("1" = urban, and "0" = rural). The definition of physician specialist resources is the number of physician specialists per 1,000 capita.

This study used Medicare health maintenance organization (HMO) penetration and a change in unemployment to represent the degree of instability in the environment. Hospital-nurse staffing studies have often used HMO penetration as an environmental predictor (Mark & Harless, 2007; McCue et al., 2003; Zhao et al., 2008). Meanwhile, the change in unemployment rate was employed to represent environmental dynamism in healthcare studies (Menachemi, Mazurenko, Kazley, Diana, & Ford, 2012; Menachemi, Shin, Ford, & Yu, 2011). Medicare HMO penetration was measured by Medicare HMO enrollment as a percent of the total Medicare population in the county, while a change in unemployment was defined as a yearly change in the county unemployment rate. Both variables were also measured at the county level.

Lastly, the current study used a health service area (HSA)-level variable to measure the level of competition in the environment using the Herfindahl-Hirschman Index (HHI). HHI is a frequently used measure indicating market concentration in the healthcare literature (Banaszak-Holl, Zinn, & Mor, 1996; Kazley & Ozcan, 2007; Trinh & O'Connor, 2002). High-market concentration indicates low-market competition. HHI was computed by the sum of squared market share of all hospitals in Dartmouth's Health Service Area (HSA).

Organizational Factors

Six variables were used as controls for organizational characteristics: bed size, system affiliation, ownership, teaching status, occupancy rate, and Magnet status. The current study defined bed size as the number of staffed beds. This study defined system affiliation as a hospital's membership in multihospital systems (a binary measure whose value "1" implies that the hospital is system-affiliated, whereas value "0" indicates non-system affiliated status). Given the sample frame of this paper, ownership was defined as the status of a hospital as a for-profit, not-for-profit private, and public entity, and operationalized it as a categorical variable whose value "1" means for-profit status, whereas value "2" and "3" represent not-for-profit private and public statuses. The reference category is the for-profit status ("1").

Zhao et al. (2008) determined teaching status by checking if a hospital was a member of the Council of Teaching Hospitals (COTH) or if a hospital was approved for its residency program, where Bloom et al. (1997, p. 151) measured it by using the "existence of a medical residency program" as an indicator. The AHA additionally provides information on the status of medical school affiliation. Therefore, this paper defined teaching status as whether a hospital meets any of the following three criteria: (1) approved medical residency program, (2) member of Council of Teaching Hospitals, or (3) affiliation with medical school. The variable was operationalized it as a binary measure whose value "1" indicates a teaching hospital, whereas value "0" means a non-teaching hospital.

Occupancy rate represents the extent of utilization of a hospital's licensed beds. This study defined occupancy rate as the ratio of total inpatient days to the number of staffed beds times 365, based on Gapenski (2003, pp. 460-461).
This study controls for Magnet status representing better nurse staffing with more favorable work conditions for nurses (Aiken, Sloane, Lake, Sochalski, & Weber, 1999). Magnet status represents hospitals that have recruited and retained nurses successfully by the provision of professional work conditions for RNs (Mark et al., 2007). This paper operationalized it as a binary measure whose value "1" indicates a Magnet hospital, whereas value "0" means a non-Magnet hospital.

Lastly, a staffing measure, LPN staffing level, was included as a control variable. LPN staffing level, which indicates how intensely LPNs are used in delivering care, was defined as the number of LPN FTEs per 1,000 inpatient days, based on a previous study (Everhart et al., 2013).

STATISTICAL ANALYSIS PLAN

The current study included univariate descriptive analysis and multivariate analysis using the random-effects linear regression model. Descriptive statistics were used to identify distributional properties of all variables and include frequencies, means, and standard deviations. Next, this paper used the random-effects linear regression model to measure the relationship between nurse staffing, quality, and financial outcomes. In a longitudinal analysis, the fixed-effects or random-effects models are often used because these models take account of biased estimates from using repeated observations per individual via controlling for fixed or random individual differences.

The fixed-effects model assumes that unobserved individual effects are correlated with regressors, so it eliminates any time-invariant effects, whereas the random-effects model assumes that the unobserved individual effects are uncorrelated with regressors. By "ruling out" the time-invariant factors, the fixed-effects model can produce unbiased coefficients but provides no estimation of all time-constant effects and poor estimates if there is little variation in variables. In contrast, by its assumption of unobserved heterogeneity, the random-effects model can include any time invariant variables in the regression model and estimate their effects. The random-effects regression model was chosen because it was found that our main independent variable did not change much over time, so its effect might be absorbed in the fixed effects model. In addition, time- and state-fixed effects were included to control for the effect of time in panel data and inter-state differences, respectively. Moreover, robust standard errors were estimated to control for inter-entity differences.

Lastly, this study tested a mediating effect of quality on the relationship between nurse staffing and profitability. To test a mediating effect, the coefficients of interest were compared in a series of random-effects regression analyses, based on the approach of a previous study (Baron & Kenny, 1986). Baron and Kenny described conditions that satisfy a mediating effect as follows: (a) the significant relationship between predictor and mediator; (b) the significant relationship between predictor and outcome variable; (c) the significant relationship between mediator and outcome variable when regressing outcome variable on predictor and mediator; and (d) no relationship between predictor and outcome variable in the condition (c) or decreased impact of predictor on outcome variable after controlling mediator (Baron & Kenny, 1986).

FINDINGS

Descriptive Statistics

The descriptive statistics of the sample of 15,955 hospital-years are shown in Table 2. A majority of sample hospitals were non-teaching hospitals (74.9%), non-Magnet hospitals (94.5%), not-for-profit (62.7%), affiliated with multihospital systems (56.5%), and in urban settings (69.0%). On average, the sample hospitals had 165 beds, which were occupied about 53% and their readmission rate for pneumonia was about 18%. Between 2006 and 2010, the hospitals showed an average of 3% of profit margin, -2% of operating margin, and 7% of cash flow margin. Regarding

the levels of nurse staffing, hospitals in the sample had an average of 8.8 RN FTEs and 1.6 LPN FTEs per inpatient day.

Table 2. Descriptive Statistics (Moving Averages Data from 2006/2007 to 2009/2010)

Variable	Hospital/Years	Mean/frequency (%)	SD
Dependent Variables			
Total profit margin	15,490	0.03	0.09
Operating margin	15,739	-0.02	0.13
Cash flow margin	15,009	0.07	0.10
Mediator			
Pneumonia readmission rate	15,955	0.18	0.16
Independent Variable			
RN staffing level	15,932	8.76	6.58
Control variables			
Environment factors			
Per capita income ($1,000)	15,830	35.97	9.10
Specialist resources (per 1000)	15,909	1.07	1.04
Urban location	15955		
Urban		11,012(69.0%)	
Rural		4,943(31.0%)	
Medicare HMO penetration	15,864	0.18	0.13
Change in unemployment rate	15,929	0.21	0.28
HHI	15,887	0.77	0.32
Organizational factors			
Bed	15,897	165.29	172.96
System affiliation	15,955		
Affiliated		9,107(56.5%)	-
Not-affiliated		6,938(43.5%)	-
Ownership	15,955		
For-profit		2,413(15.1%)	-
Not-for-profit, private		9,996(62.7%)	-
Not-for-profit, public (non-federal)		3,546(22.2%)	-
Teaching status	15,955		
Teaching hospital		4,011(25.1%)	-
Non-teaching hospital		11,944(74.9%)	-
Occupancy rate	15,863	0.53	0.19
Magnet hospital status	15,955		
Magnet hospital		875(5.5%)	-
Non-magnet hospital		15,080(94.5%)	-
LPN staffing level	15,950	1.55	2.25

The sample hospitals were located in counties whose population earned $35,970 per year and whose HHI was 0.77. On average. 1.1 specialists served a population of 1,000 and 18% of Medicare-

eligible patients were enrolled in Medicare HMOs. Lastly, the average annual change in unemployment was 21%.

Random Effects Linear Regression

In multivariate analysis, controlling for environmental/organizational factors and LPN staffing level, it was found that RN staffing was associated with both quality and financial outcomes. For each financial outcome variable, two different regressions models were used to test potential mediating effects of quality (see Table 3). The only difference between the two models is that model 2 included the quality variable as a predictor as well as a potential mediator. These two models were compared to capture the change in the association between nurse staffing and financial performance when controlling for quality.

Hypothesis 1 was supported, which posited that an increase in RN staffing level would be associated with an increase in quality. Compared to hospitals in the lowest quintile of RN staffing level, hospitals in the third, fourth, and fifth quintiles experienced pneumonia readmission rates that were 9.6%, 15%, and 19.7% lower, respectively (see Table 3).

Table 3. The Results of Random-Effects Regression Analysis

	Pneumonia readmission rate		Profitability			
			Model 1		Model 2	
	Coef.	SE	Coef.	SE	Coef.	SE
Total profit margin						
Pneumonia readmission rate					-0.0011º	0.0006
RN staffing level (avg. = 4.4)						
1st quintile (ref.)						
2nd quintile (6.3)	-0.0505	0.0361	0.0033	0.0023	0.0032	0.0023
3rd quintile (7.7)	-0.0951*	0.0414	0.0076**	0.0026	0.0075**	0.0026
4th quintile (9.6)	-0.1495**	0.0452	0.0046	0.0030	0.0044	0.0030
5th quintile (16.5)	-0.1970***	0.0527	0.0052	0.0035	0.0050	0.0035
Operating margin						
Pneumonia readmission rate					-0.0011	0.0007
RN staffing level						
1st quintile (ref.)						
2nd quintile			0.0042***	0.0032	0.0041	0.0032
3rd quintile			0.0080***	0.0036	0.0079*	0.0036
4th quintile			0.0078***	0.0041	0.0077º	0.0041
5th quintile			0.0068***	0.0048	0.0066	0.0048
Cash flow margin						
Pneumonia readmission rate					-0.0013*	0.0006
RN staffing level						
1st quintile (ref.)						
2nd quintile			0.0063*	0.0025	0.0063*	0.0025
3rd quintile			0.0089**	0.0028	0.0088**	0.0028
4th quintile			0.0070*	0.0032	0.0068*	0.0032
5th quintile			0.0088*	0.0039	0.0086*	0.0039
º $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$						
*Six environmental factors (per capita income, urban location, specialist resources, Medicare HMO penetration, change in unemployment rate and HHI), seven organizational factors (beds, squared beds, system affiliation, ownership, teaching status, occupancy rate and Magnet hospital status), and LPN staffing level were controlled in all regression models.						

With respect to Hypothesis 2 that posited a positive association between quality and profitability in hospitals, the analysis provided support: a 1% increase in pneumonia readmission rate was associated with a decrease of 0.11% in total profit margin and 0.13% in cash flow margin. The relationship between pneumonia readmission rate and profit margin was marginally significant (P = 0.057).

Hypothesis 3 postulated that an increase in RN staffing level would be related to an increase in hospital profitability. It was found that a higher RN staffing level was associated with a higher total

profit margin. Compared to hospitals in the lowest quintile of RN staffing level, hospitals in the third quintile had a 0.76% higher total profit margin (see model 1 in Table 3). In model 2, the same results were found, except for finding a slightly lower coefficient (0.75%). With respect to operating margin, a positive relationship was found with the RN staffing level. Compared to hospitals in the lowest quintile of RN staffing level, hospitals in the second, third, fourth, and fifth quintiles had operating margins that were 0.42%, 0.8%, 0.78%, and 0.68% higher, respectively (see model 1 in Table 3).

Somewhat different results were found when controlling for quality. Compared to hospitals in the lowest quintile, hospitals in only the third and fourth quintiles had operating margins that were 0.79% and 0.77%, higher, respectively (see model 2 in Table 3). In addition, the results of the analysis showed that RN staffing level was also positively associated with cash flow margin. Compared to hospitals in the lowest quintile of RN staffing level, hospitals in the second, third, fourth, and fifth quintiles had cash flow margins that were 0.63%, 089%, 0.7%, and 0.88% higher, respectively (see model 1 in Table 3). Model 2 presented the almost identical results with slightly lower coefficients (see model 2 in Table 3). Therefore, these findings strongly support Hypothesis 3.

Hypothesis 4, postulating a mediating effect of quality on the relationship between RN staffing and profitability, was supported. Specifically, compared to hospitals in the bottom quintile of RN staffing level, hospitals in the third quintile had a 9.5% lower pneumonia readmission rate (condition (a)), but a 0.76% higher total margin (condition (b)), whereas finding that a decrease in pneumonia readmission rate accounted for 0.11% of the increase in total margin (condition (c)) (see Table 3). When controlling pneumonia readmission, the 0.76% higher total margin of hospitals in the third quintile decreased slightly to 0.75% (condition (d)). Because all conditions given were met and the impact of RN staffing level on total profit margin decreased but still remained significantly, a partial mediating effect of quality on the relationship between RN staffing level and profitability was confirmed, which supported Hypothesis 4. In the same approach, a partial mediating effect of quality on the relationship between RN staffing level and cash flow margin among hospitals in the third, fourth, and fifth quintiles of RN staffing level was also found.

DISCUSSION
The aim of this paper emerged from the literature gaps in terms of the limited empirical findings on the relationship between nurse staffing and financial performance in hospitals. Based on the resource based view of the firm perspective, this paper attempted to examine how nurse staffing is associated with quality, and profitability in hospitals, with a special interest on the mediating effect of quality on the relationship between nurse staffing and profitability. Our research findings add to the knowledge with empirical evidence that nurse staffing was associated with profitability and this association was partially mediated by the quality of care provided.

Overall, the findings of this study strongly supported the hypotheses that the use of more RNs relative to the amount of care delivered would be associated with higher quality, as well as with higher profitability. In this study, a higher RN staffing level was significantly associated with a lower pneumonia readmission rate. This finding demonstrated that, as hospitals with higher levels of RN staffing were compared to the reference hospitals with the lowest levels of RN staffing, the reduction in the pneumonia readmission rate continued to increase. This is consistent with

McHugh and Ma (2013) who found the increased odds of pneumonia readmission by the increase in the patient-to-nurse ratio.

It was observed that higher quality was significantly associated with higher profitability in hospitals. We found that an increase in pneumonia readmission rate was associated with lower total profit margin and cash flow margin. It is important to note that these findings were based on the data collected prior to the ACA, but the readmission rate had an unfavorable impact on the profitability, despite hospitals having a reputation for being unmotivated to avoid preventable readmissions because they were reimbursed for the care provided during readmission. (Navathe et al., 2012). Given the government payment reforms, our research results suggest that the impact of quality on profitability might have increased since 2012. In addition, considering the significant association between RN staffing level and pneumonia readmission rate, the importance of ensuring proper levels of RNs per inpatient day might have also increased in hospitals after the HRRP. Our study results suggest that more RNs per 1,000 inpatient days may be related to an increase in hospital profitability.

It was found that a higher RN staffing level was significantly associated with higher profitability. It is important to note that, compared to hospitals in the bottom quintile in terms of RN staffing level, hospitals in the third quintile, not the fifth, had the greatest operating margin and cash flow margin. This finding suggests that using unconditionally more RNs rather than having certain proper levels of RNs may not be an effective way to increase profitability in hospitals.

Our overall findings suggest that hospitals with a higher RN staffing level may be more profitable than hospitals with a lower RN staffing level partly because their higher RN staffing levels are related to a higher quality of patient care, and the higher quality of patient care is related to an increase in hospital profitability. In this analysis, four partial mediating effects of pneumonia readmission rate levels were captured only in the associations of RN staffing level with total profit margin and cash flow margin in hospitals in which RN staffing level was medium to high (i.e., hospitals in the third, fourth, or fifth quintiles that had an average of 7.7 to 16.5 RNs per inpatient day. These findings suggest that for hospitals, there may be certain levels of RN staffing that can effectively produce higher quality, thereby generating higher profitability, compared to different levels of RN staffing.

There were limitations to this study. First, this paper used the hospital-level data that did not provide information on unit-level staffing. A very profitable hospital may have low RN staffing level because its small number of major and most profitable service line units were all staffed with RNs, but its overall medical and surgical units and less profitable and costly units (e.g., obstetrics) were relatively less staffed with RNs. Therefore, without knowing the unit-level staffing information, the relationship between nurse staffing and hospital performance cannot be fully understood.

Second, this study used the Baron and Kenny approach to test a mediating effect, which was extensively utilized in the nursing literature (Krause et al., 2010). However, this approach has also attracted a fair amount of critical attention. Therefore, some argument can be made on the results regarding the mediating effects of quality, especially on the absence of significance test regarding mediating effects.

Third, an important factor, such as nurse turnover, could not be controlled in this study model because of a lack of data accessibility. Research findings may have limited implications when subjected to the omitted variable bias due to the exclusion of important variables. Therefore, the findings of the current study should be interpreted in light of this limitation.

Fourth, previous nurse staffing studies used multiple measures of nurse staffing to capture potentially different staffing patterns or strategies in hospitals. However, this study used only one nurse staffing measure due to the complexity of the study model designed to capture a mediating effect. So, our results should be interpreted based on the understanding that this study measured nurse staffing by focusing on how many RNs were staffed to provide a certain amount of medical services.

Lastly, this paper employed the random-effects model because there was reason to believe that our independent variable did not vary much over time. When there is little variation in regressors, the fixed-effects model may produce poor estimates. The random-effects model is known to be more efficient than the fixed-effects model when its assumption of uncorrelated individual effects on independent variables is held. However, if it does not hold, the random-effects model becomes inconsistent. Therefore, this study's results should be interpreted with caution by focusing on association, not on causality inference.

CONCLUSION

On a practical level, the findings on the relationship between nurse staffing, and the quality and financial outcomes in hospitals can assist nurse managers and chief executive officers in identifying the optimal RN staffing level. These findings suggest that RN staffing level may be a strong predictor of quality and profitability and that the quality may mediate the relationship between RN staffing level and profitability in hospitals. This could be of particular interest to current hospital managers because of the payment reductions for excessive readmissions embedded in the ACA, which might have significantly affected the average profitability of some service lines in their hospitals. A lesson that can be learned from the past is that hospitals may attempt staff reductions in response to increased financial pressures as a result of payment reforms. However, as the findings in this research and the literature suggest, the reduction of nursing staffs may be related to an increase in adverse effect on the quality of patient care. The analysis results of this study demonstrated that a higher RN staffing level was associated with a lower pneumonia readmission rate, while the medium level of RN staffing level (≈ 7.7 RNs per inpatient day) had the highest profitability among general and acute care, non-federal government hospitals. Staffing decisions involve balancing between labor costs and the level of care required to fulfill healthcare needs of patients (Blegen, Vaughn, & Vojir, 2008). It is a matter of choice to hospital managers to decide what would be the most effective nurse staffing strategy for their hospitals in response to the HRRP.

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